(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 042 723**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 81302726.5

(22) Date of filing: 17.06.81

(51) Int. Cl.³: A 47 L 9/16

(30) Priority: 19.06.80 GB 8020041
08.08.80 GB 8025960
25.09.80 GB 8030954
26.09.80 GB 8031121

(43) Date of publication of application:
30.12.81 Bulletin 81/52

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(71) Applicant: ROTORK APPLIANCES LIMITED
Rotork House Brassmill Lane
Bath BA1 3JQ(GB)

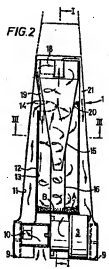
(72) Inventor: Dyson, James
Sycamore House
Bathford, BA1 7RS Bath Avon(GB)

(74) Representative: Daley, Michael John et al,
F.J. CLEVELAND & COMPANY 40/43 Chancery Lane
London, WC2A 1JQ(GB)

(54) **Vacuum cleaning appliance.**

(57) A vacuum cleaning appliance comprises a low efficiency cyclone unit and a high efficiency cyclone unit connected in series. This enables both large and fine dirt particles to be dealt with. The low efficiency cyclone has a cylindrical casing 13 containing a frusto-conical body portion 15 of the high efficiency cyclone, a pipe 14 connecting the casing 13 to the portion 15. A dirty air entry passage 11 extends up one side of the appliance and a clean air exit passage 21 descends the other side.

FIG.2



EP 0 042 723 A2

DESCRIPTION

This invention relates to a vacuum suction cleaning appliance and in particular to a portable domestic appliance of the kind described in the published EPC Specification No. 0 018 197.

EPC Specification No. 0 018 197 describes an appliance in which a cleaner head for contacting a dirty surface is connected to the interior of the casing in which an airflow is set up by a motor driven fan. The casing contains two cyclone units in series operating successfully to extract dirt

particles (dust and other extraneous matter) from the airflow therethrough and to deposit the extracted dirt.

A cleaning appliance based on cyclone units has the advantage that dust bags are not required as dirt can be discharged from the appliance by removing and separating the cyclones from the surrounding casing. Other advantages are that the air discharged from the appliance is substantially dust free and the use of filters as main cleaning elements is avoided.

In the appliance described in the said EPC patent application each of the two cyclone units has a body of substantially frusto-conical shape, this shape serving to maintain the velocity of the dirt particles swirling therein and hence render the cyclone capable of depositing fine dirt particles of small diameter. Such cyclone units with the means to maintain the velocity of the fine dirt particles will hereinafter be referred to as "high efficiency" cyclones.

This invention recognises that a vacuum cleaner incorporating only the higher efficiency cyclones necessary to deal with the fine particles does not operate entirely satisfactorily under normal domestic conditions when dirt particles of larger size and other extraneous objects are sucked into the appliance. These larger size particles tend to be retained either performing the spiral or circular motion in the cycline or drifting to the cyclone central regions and are not deposited. This causes noise and interferes with the efficient operation

of the cyclone.

Accordingly the present invention proposes incorporating into the air passage upstream, relatively to the inlet for dirty air, of the high efficiency cyclone unit a cyclone deliberately constructed to be of lower efficiency.

This "lower efficiency" cyclone though not ultimately capable of dealing effectively with the finest particles, i.e. particles of 50 microns diameter or under, carries out a primary cleaning action of the dirty air flow by depositing all but some of these finer particles. The high efficiency cyclone is then left to function in its optimum conditions with comparatively clean air and only particles of very small size.

The lower efficiency can be contrived by omitting the frusto-conical formation and constructing for example the cyclone casing of cylindrical form with the normal tangential or scroll type air inlet adjacent one end.

Thus in a convenient and preferred configuration a vacuum cleaner casing comprises a generally cylindrical "low efficiency" cyclone with an inlet for dirty air and concentrically within the low efficiency cyclone a "high efficiency" cyclone, a passageway being provided to allow air from the low efficiency cyclone to enter an end part of the high efficiency cyclone. Clean air can then be withdrawn centrally from the high efficiency cyclone and exhausted if necessary through a final filter.

A particular embodiment of the invention will now be described by way of example and with reference to the accompanying drawings wherein:-

Figure 1 is a side sectional view taken along the line I - I of Figure 2;

Figure 2 is a front sectional view taken along the line II - II of Figure 1; and

Figure 3 is a section looking upwardly along the line III - III of Figure 2.

The cleaning appliance illustrated comprises a main casing 1 adapted for use both in the vertical mode and the horizontal mode, the vertical mode being illustrated. The functioning of the appliance will be described with reference to this vertical mode. At the lower end part of the casing a cleaning head 2 is provided, the head 2 comprising a motor driven fan unit 3 and an elongate transversely extending brushing member 4 connected to the shaft of the motor by a belt 5. A pipe 6 upstands along the back of the casing 1 and serves as a handle or for a connection to other suction tools. Extending between pipe 6 and to the upper end part of the casing is a holder for electric cable 7 and an on/off switch 8 for the appliance. The electrical arrangements for the cleaning appliance form no part of the present invention and will not be described. The appliance in the upright

mode runs on wheels 9.

Dirty air entering the appliance from behind brushes 4 communicates as can best be seen in Figure 2 through a square port 10 with an entry passage 11 for dirty air defined by a part-circular sleeve 12 within the casing (see Figure 3). Centrally and coaxially within the casing 1 and slidably fitted in sleeve 12 is the cylindrical casing 13 of the first low efficiency cyclone unit. The upper end of the dirty air entrance passage 11 communicates through part 14 with the upper part of casing 13 so as to make a tangential entry and to set up a swirling cyclonic flow of air.

The high efficiency cyclone unit comprises a frusto-conical body portion 15 and a dependant cylindrical portion 16, the lower end part of which abuts against a support plate 17 on the base of the low efficiency cyclone casing 13. Outside of the frusto-conical part and extending to a tangential entry port 18 is an entry pipe 19 to the high efficiency cyclone from the interior of the lower efficiency cyclone. The high efficiency cyclone unit is removable upwardly from the low efficiency cyclone unit and flexible bearing seals 20 are provided between the units. The upper end of the high efficiency cyclone communicates with a passage 21 at the side of the cleaner opposite to the dirty air entry passage and defined between sleeve 12 and the cleaner outer casing. The lower end part of this passage communicates through the motor fan to exhaust.

The operation of the appliance will now be described with reference to the air flow designated

by arrows differently marked to show the successive progress of the dirty air through the interior of the casing and the two cyclone units. ——→ represents dirty air, —·—→ air cleaned by the low efficiency cyclone, —··—→ air cleaned by the high efficiency cyclone, and —···—→ finally discharged air. In operation of the device with the rotating brush 4 and the suction developed by the motor fan 3, dirty air carrying dust and other particles is drawn into the dirty air entry passage 11. The airstream carrying the dirt particles makes a tangential entry through port 14 into the upper part of the low efficiency cyclone casing 13 and performs cyclonic swirling movement generally along the line of the arrows and thereby deposits the majority of the dust particles in the lower part of the low efficiency cyclone as indicated at A. The airstream carrying only the finer particles then rises under the influence of the general airflow developed by the fan through pipe 19 and entry port 18 to a tangential entry to the high efficiency cyclone unit where the cyclonic cleaning process is repeated only with higher efficiency and greater particle velocity thereby contriving the deposit of the finer particles at B. The ultimately clean air rises under the influence of the air flow to the upper part of the high efficiency cyclone and returns through the clean air exit pipe 2 to the motor fan and exhaust possibly with a final filter.

The low efficiency cyclone consumes less power than the high efficiency cyclone so the appliance as a whole consumes less power than an appliance based on two high efficiency cyclones.

For discharge of particles the lower and high efficiency cyclone casings are removed and disengaged from one another. It will be appreciated that when the high efficiency cyclone casing 16 is lifted from its seating on the base of the low efficiency cyclone casing 13 the contents thereof will be deposited so that the cylindrical body holds all the deposited particles. If desired a disposable liner can be provided for the low efficiency cyclone casing.

Means not shown may be provided for manually throttling the entry or exit pipe to the high efficiency cyclone. If the size of the entry or exit orifice to the cyclone is reduced then suction pressure is reduced but separation in efficiency is enhanced. For use of the appliance in the pure suction mode a valve schematically indicated at 22 is provided which is rotatable to close airflow from the brushes and to open the air passage to the pipe 6 and any suction tools connected thereto.

In the appliance described above a "clean" fan is used; that is to say the dirty air entering the appliance does not pass through the fan 3. The fan 3 receives only cleaned air which it discharges to exhaust. The invention is also applicable to "dirty" fan arrangements wherein the dirty air is drawn into the machine through the fan. The low efficiency cyclone described has a cylindrical body but a taper reverse to that of the high efficiency cyclone body is envisaged.

CLAIMS

1. A vacuum cleaning appliance including a cyclone unit and means for generating an airflow from a dirty air inlet through the said cyclone unit the cyclone unit being of a high efficiency having the capability of depositing fine dust particles and the appliance being characterised by a lower efficiency cyclone unit in the air path upstream of the high efficiency unit.

2. A vacuum cleaning appliance according to Claim 1 characterised by a casing 1 with a dirty air inlet, a generally cylindrical container 13 constituting the lower efficiency cyclone unit positioned within the casing and being connected to the dirty air inlet, the high efficiency cyclone having a frusto-conical body part 15 and being positioned within the lower efficiency cyclone unit, air being caused to flow from the low to the high efficiency cylone unit.

3. A vacuum cleaning appliance according to Claim 2 characterised by a dirty air entry passage 11 extending up one side of the casing to the entry port 14 to container 13 and a clean air

exit passage 21 extending down the other side of the casing from the exit to body part 15, a pipe 14 connecting the low and high efficiency cyclone units.

FIG.1

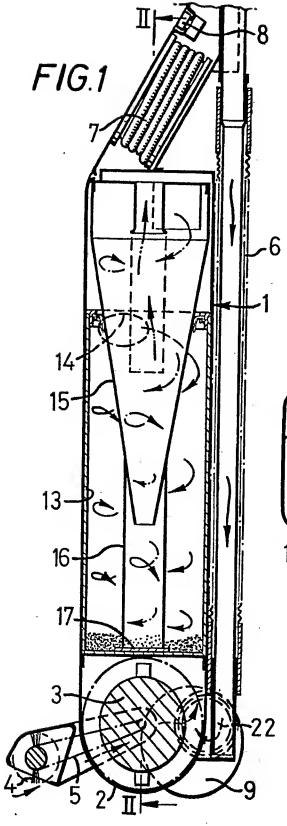


FIG.3

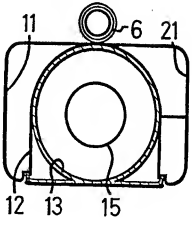


FIG.2